The opinion in support of the decision being entered today
is *not* binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte WILLIAM A. HUFFMAN

Appeal 2007-0662
Application 09/909,704
Technology Center 2100

Decided: September 24, 2007

Before ANITA PELLMAN GROSS, MAHSHID D. SAADAT,
and JEAN R. HOMERE, *Administrative Patent Judges*.

SAADAT, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellant appeals under 35 U.S.C. § 134(a) from the Examiner's
rejection of claims 1-15, which are all of the claims pending in this
application. We have jurisdiction under 35 U.S.C. § 6(b).

Appellant invented a system for managing distributed shared memory
by providing a memory arbitration scheme that includes an arbitration
queue. Entries are received from any point in the queue and higher order

entries ripple down to fill the voids in the queue created by previously serviced entries (Specification 6).

Claim 1 is representative of the claims on appeal and reads as follows:

1. A method of managing an arbitration queue having a plurality of queue entries comprising:

introducing entries into the queue at a first, highest order queue location;

determining if lower order queue locations are available;

if lower order queue locations are available, moving all higher order queue location contents to an adjacent lower order queue location per cycle until all lower order locations are filled;

associating each entry after placement in the queue to one of a plurality of groups, each of the plurality of groups having a different transaction parameter criteria;

determining which particular one of the plurality of groups to service based on the transaction parameter criteria;

servicing a particular entry in the particular one of the plurality of groups based on servicing criteria; and

moving all higher order queue entries, with respect to the particular entry being serviced, to an adjacent lower order location in the queue.

The evidence relied upon by the Examiner in rejecting the claims on appeal is:

Meyers	US 5,375,223	Dec. 20, 1994
Garcia	US 6,145,061	Nov. 7, 2000
Bauman	US 6,160,812	Dec. 12, 2000
Trull	US 6,185,672 B1	Feb. 6, 2001

In re Yount, 171 F.2d 317, 80 USPQ 141 (CCPA 1948).

The rejections as presented by the Examiner are as follows:

1. Claims 1-3 and 5-7 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Bauman and Trull.

2. Claim 4 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Bauman, Trull, and Garcia.

3. Claim 8 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Bauman, Trull, and in view of *In re Yount*.[1]

4. Claims 9-14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Meyers, Bauman, and Trull.

5. Claim 15 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Meyers, Bauman, Trull, and in view of *In re Yount*.

ISSUES

(1) Under 35 U.S.C § 103(a), with respect to appealed claims 1-3 and 5-7, would one of ordinary skill in the art at the time of the invention have found it obvious to combine Bauman and Trull to render the claimed invention unpatentable?

(2) Under 35 U.S.C § 103(a), with respect to appealed claims 4 and 8-15, would the ordinarily skilled artisan have found it obvious to modify the combination of Bauman and Trull separately with

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[1] The Examiner probably meant to include *In re Yount* in order to support the propriety of the combination of Bauman and Trull.

either Garcia, *In re Yount*, or Meyers to render the claimed invention unpatentable?

FINDINGS OF FACT

The following findings of fact (FF) are relevant to the issues involved in the appeal and are believed to be supported by a preponderance of the evidence.

1. Bauman relates to a method and apparatus for supplying new requests to a scheduler in an input-buffered multiport switch which involves selecting a request that does not target a conflicting output channel targeted by requests that are already accessible to the scheduler (Abstract).

2. Bauman fills the request buffers according to the packet priority scheme implemented in the switch, such that if the scheme is based on time, the oldest request has the highest priority (col. 8, ll. 15-21) while other factors may also be used as the basis for the priority scheme such as the source of data or the type of data (col. 8, ll. 33-36).

3. As depicted in Figure 17, Bauman provides for input-output controllers 242, 244, 246, and 248 which supply the scheduler with new requests formed in request queues 252, 254, 256, and 258 while queue managers 262-268 and secondary schedulers 272-278 process the requests from the queue (col. 16, ll. 17-36).

4. The request queues 252-258 depicted within each I/O controller 242-248 relate on a one-to-one basis to the ports 292, 294, 296, and 298 that are connected to the I/O controller or may be queued in a single request queue if only one port is available. The request queues are time-ordered

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queues such that the oldest request is depicted at the bottom of the queue and the youngest request is depicted at the top of the queue, although this is not critical to the invention (col. 16, ll. 37-45).

5.   Bauman further discloses that the secondary schedulers 272-278 are the units that arbitrate which requests, from the group of requests that are stored in the request queues 252-258, will be supplied to the primary arbitration queue when a new request is needed for the primary scheduler 132 (col. 16, ll. 60-64).

6.   Figure 18 of Bauman shows that a section of the time-ordered request queue 252 are considered by the secondary scheduler 272 for arbitration by the primary arbitrator 282 (col. 17, ll. 14-20).

7.   As shown in Figure 19 of Bauman, the requests in the secondary arbitration queue 302 are ordered from oldest to youngest, with the oldest request being at the bottom of the queue and the youngest request being at the top of the queue (col. 17, ll. 54-59).

8.   In the example depicted in Figure 19, the secondary scheduler 272 first compares the oldest request in the secondary arbitration queue 302, identifying output channel 0, to the primary arbitration queue 282. Since there is a conflict at output channel 0, the oldest request is bypassed. Similarly the next 2 youngest requests, identifying output channels 1 and 3, are then compared to the primary arbitration queue and there is a conflict at both output channels 1 and 3. The next youngest request, corresponding to output channel 2, which does not conflict with any of the output channels requested in the primary arbitration queue is supplied to the primary

scheduler as the new request that is the next oldest and does not identify a conflicting output channel (col. 18, ll. 6-25).

9.   Trull relates to a microprocessor having an instruction queue capable of out-of-order instruction dispatch and compaction of unaligned strings of empty storage locations. This compaction may be performed by selectively shifting the instructions remaining in the queue either zero or N storage locations, wherein N is a predetermined positive integer (Abstract).

10.   Trull identifies the large size of the queue with slowing down and negative effects on the performance of the device (col. 3, ll. 34-45), specially where the microprocessor may be configured to read instructions from an instruction cache, store them in a queue, and then read them from the queue in an out-of-order fashion (col. 3, ll. 52-54). Reading the instructions in this manner may create bubbles or gaps of empty storage locations within the queue, which may be compacted out by shifting the remaining instructions a fixed number of storage locations (col. 3, ll. 54-58).

11.   Trull further teaches that new instructions are written into the "top" or start of the queue, while the oldest eligible instructions are read from different positions within the queue. As instructions are read out of the queue, bubbles of empty storage locations form in the queue. To reduce or eliminate these bubbles, the remaining instructions in the queue are shifted down the queue, thereby making room for new instructions at the top of the queue. When instructions are shifted in the queue (referred to as the "compaction" process), the instructions are shifted from their current storage location to a corresponding destination storage location further down the queue (col. 45, ll. 31-42).

PRINCIPLES OF LAW

To reach a conclusion of obviousness under section 103, the Examiner bears the burden of producing factual basis supported by teaching in a prior art reference or shown to be common knowledge of unquestionable demonstration. Our reviewing court requires this evidence in order to establish a prima facie case. *In re Piasecki*, 745 F.2d 1468, 1471-72, 223 USPQ 785, 787-88 (Fed. Cir. 1984).

Furthermore, the test for obviousness is what the combined teachings of the references would have suggested to one of ordinary skill in the art. *See In re Kahn*, 441 F.3d 977, 987-88, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006), *In re Young*, 927 F.2d 588, 591, 18 USPQ2d 1089, 1091 (Fed. Cir. 1991) and *In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981).

"Section 103 forbids issuance of a patent when 'the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.'" *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1734, 82 USPQ2d 1385, 1391 (2007).

"The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *Leapfrog Enter., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1161, 82 USPQ2d 1687, 1691 (Fed. Cir. 2007) (quoting *KSR Int'l v. Teleflex, Inc.*, 127 S. Ct. 1727, 1739, 82 USPQ2d 1385, 1395 (2007)). "One of the ways in

which a patent's subject matter can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims." *KSR*, 127 S. Ct. at 1742, 82 USPQ2d at 1397.

ANALYSIS

Rejection of claims 1-3 and 5-7 over Bauman and Trull

Appellant contends that Bauman processes requests from the request buffer based on the order they were placed in the buffer or according to a FIFO scheme (Br. 10). Based on such interpretation, Appellant argues that one of ordinary skill in the art would not combine Bauman's FIFO approach with the out of order dispatch of Trull since they relate to different functionalities (Br. 8). Specifically, Appellant contends that Bauman uses four registers in either a first in first out manner or a first priority manner and cannot be combined with Trull which dispatches instructions from an instruction queue in an out of order manner (Br. 8). Appellant further argues that the requests in Bauman enter the request queue in a time ordered manner while the grouping of requests is determined prior to placement into a request queue (Br. 10). Appellant specifically refers to request queue 282 of Bauman and asserts that once in request queue 282, there is no further grouping of the requests as arbitration is performed among all of the requests therein (*id.*). The Examiner argues that Bauman places packets in request queues 252-258 before grouping them into primary arbitration queues 282-288 (Answer 23). The Examiner concludes that the priority scheme used by Bauman for grouping the request into primary arbitration queues 282-288 is

the same as the claimed associating the entries to one of a plurality of groups having different transaction parameter criteria (*id.*).

Initially, we note that Appellant's arguments appear to challenge characterizing the four registers in primary arbitration queue 282 of Bauman as the claimed queue containing the entries. As such, Appellant states that the four register buffers are used as FIFO buffers causing the request at its L0 register always to leave first (Reply Br. 9). In fact, the Examiner relies on request queues 252-258 of Bauman as the entry queues, which are grouped into primary arbitration queues 282-288 (FF 3-6). While the primary registers 282-288 may use FIFO as one of the schemes for arranging the requests and servicing them accordingly (FF 8), other priority schemes may also be used for arranging the requests into the group in primary arbitration queues 282-288 (FF2).

Additionally, Bauman may move a request from any part of queue 252 to queue 282, based on the requirements set forth by the application such as output availability (FF 6). Once the requirement is met, the youngest entry that meets the requirement is taken from its location in the queue and supplied to the primary arbitration queue, where it may be organized, among other schemes, in a FIFO scheme (FFs 7-8). Therefore, we disagree with Appellant (Br. 8-9) that such process, by which an empty position in the queue is created, is in conflict with the teachings of Trull and may not benefit from compaction of the instruction queue taught by Trull (FFs 9-10).

Additionally, we remain unconvinced by Appellant's assertion (Br. 9-10) that grouping of the requests of Bauman is determined prior to placing

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them in the queue. In that regard, as pointed out *supra*, the grouping is actually achieved by selecting entries from the request queue 252 to be placed in the primary arbitration queue 282 (FF 8). Therefore, using the compaction scheme of Trull in arrangement of the request queue 252 of Bauman is not in conflict with the principals of the references and does provide the claimed functionality.

Furthermore, contrary to Appellant's assertion against combinability of the references (Br. 7), combining Bauman and Trull is based on common schemes for efficient use of queues once empty storage locations are present in a queue. Trull shifts the instructions in a queue by a predetermined number in order to fill the gap left by the instructions pulled out of order for processing (FF 9-10). In fact, since Trull's instructions are more efficiently written into the "top" position of the queue and the gap left behind after instructions are read out is eliminated by shifting down the instructions in the queue (FF 10), one of ordinary skill in the art would have combined the references to benefit from the compaction scheme of Trull (FF 11).

Thus, in light of these findings, we find that the combination of Bauman and Trull suggests the subject matter of Claim 1 as well as claims 2, 3, and 5-7, argued together as one group.

Rejection of claims 4 and 8 over Bauman, Trull, and In re Yount

Appellant relies on the same arguments previously raised for claim 1 and asserts that Garcia adds nothing to the combination of Bauman and Trull that would have made the subject matter of claim 4 unpatentable (Br. 12). Similarly, Appellant provides no additional arguments for claim 8 and merely relies on the arguments made for patentability of claim 1 (Br. 13).

Therefore, in light of our findings above, we find that the teachings of Bauman and Trull combined with Garcia or *In re Yount* suggest the subject matter of Claims 4 and 8. *See In re Young*, 927 F.2d 588, 590, 18 USPQ2d 1089, 1091 (Fed. Cir. 1991). *See also* 37 C.F.R. § 41.37(c)(1)(vii).

Rejection of claims 9-14 over Meyers, Bauman, and Trull

Appellant argues that the Examiner has not shown that Bauman and Trull may be properly combined and shift registers be incorporated as taught by Meyers (Br. 14; Reply Br. 16). Appellant further asserts that the combination of the references would still be unable to group entries after their placement into a queue followed by servicing of a particular entry of a group, as required by the claims (Br. 15; Reply Br. 17). The Examiner points to the arguments made with respect to claim 1 and states that the rejection is based on combining Bauman and Trull with the computer system of Meyers (Answer 26-29).

We agree with the Examiner and find that combining Meyers with Bauman and Trull requires nothing more than combining familiar elements producing predictable results. Not only does the combination of Bauman and Trull teach collapsing the queue and grouping the requests according to different transaction parameter criteria, but also one of ordinary skill in the art would have used such arrangement for improving the arbitration queue in the distributed memory system of Meyers. Accordingly, we find the Examiner's position rejecting these claims to be reasonable.

Rejection of claim 15 over Meyers, Bauman, Trull, and In re Yount

Appellant provides no additional arguments for claim 15 and merely relies on the arguments made for the patentability of claim 9 (Br. 16).

Therefore, in light of our findings above, we find that the teachings of Meyers as combined with Bauman and Trull in view of *In re Yount* suggest the subject matter of claims 15. *See In re Young,* 927 F.2d at 590, 18 USPQ2d at 1091 (Fed. Cir. 1991). *See also* 37 C.F.R. § 41.37(c)(1)(vii).

CONCLUSION OF LAW

Because Appellant has failed to point to any error in the Examiner's position, we sustain the 35 U.S.C. § 103 rejection of claims 1-3 and 5-7 over Bauman and Trull; of claim 4 over Bauman, Trull, and Garcia; of claim 8 over Bauman, Trull, and *In re Yount*; of claims 9-14 over Meyers, Bauman, and Trull; and of claim 15 over Meyers, Bauman, Trull, and in view of *In re Yount*.

DECISION

The decision of the Examiner rejecting claims 1-15 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

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